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ration, than wheat-starch. It is to the want of attention to these circumstances that the author assigns the different results given by chemists with respect to the composition of this principle; which in the abstract, or free from water, he considers as identical with cane-sugar similarly circumstanced.

The next principle considered is vinegar, a substance that in almost all ages and countries, either by accident or design, has been more or less used as an aliment. The author states that he had reason to suspect long ago that the hydrogen and oxygen in this acid existed in the proportions which form water, but that he was not completely able to satisfy himself on the point till he employed the present apparatus. He decided the point by means of the acetate of copper, which produced no change of bulk in the oxygen employed. He states this acid to consist of carbon 47·05, and water 52·95; results that very nearly agree with those of other chemists. This principle is not, however, in the protorganized state, except the acid found in almost all animal matters, and hitherto called the Lactic acid, be deserving of that appellation.

The last substance connected with this series is *lignin*, or the woody fibre, a principle subject to all the varieties of starch before mentioned. The author finds the composition of this principle, in the abstract, as containing carbon 57·14, water 52·86; and observes, that he is not acquainted with it in the crystallized state, but that he has no doubt of its existence. In proof of the alimentary qualities of this principle, he quotes the experiments of Professor Autenrieth, of Tübingen, who states that when wood is reduced to a minute state of division, and subjected to other processes, which he describes, it is capable of gelatinizing like starch when boiled in water, and of forming bread.

The sugar of milk is next considered. This, in its crystallized state, is composed of carbon 45·45, water 54·54. Gum-arabic, according to the author, is this substance in the protorganized state, and, like all analogous substances, combines with any proportion of water; and hence the different compositions assigned to it by different chemists.

As connected with this subject, the author next proceeds to consider the oxalic, citric, tartaric, and saccholactic acids, the composition of each of which is given; and concludes by observing, that he purposely refrains from all chemical observations, till the whole of the facts in his possession are laid before the Society.

Experiments to ascertain the Ratio of the Magnetic Forces acting on a Needle suspended horizontally, in Paris and in London. By Captain Edward Sabine, of the Royal Artillery, Sec. R.S. Read June 21, 1827. [Phil. Trans. 1828, p. 1.]

The needles used in these experiments were cylinders 0·16th of an inch in diameter, and 2·4 inches in length, pointed at the ends, and suspended by a silk fibre 5 inches long, over the centre of a graduated

ivory circle. The needle, previous to beginning to count the vibrations, was drawn 50° or 60° from the magnetic meridian by another needle, and left to oscillate. When it had reduced its arc of vibration to 30° , the counting of its vibrations was commenced, and terminated at 5° . It usually took between 300 and 400 vibrations to reduce the arc of vibration to this limit, occupying from 12 to 16 minutes. Four of the needles, with an apparatus in duplicate, were sent to the author from Professor Hansteen of Christiana, to be employed in comparative experiments in various parts of Great Britain. They were vibrated in Edinburgh by Captain Basil Hall and Lieut. Robert Craigie, and the results are set down with the rest in this paper. The needles being returned, were also used in the experiments between Paris and London. The two remaining needles were made by Dollond, of the same size and form as Professor Hansteen's. The author then relates his experiments, which were made on the 3rd of December, about seven weeks previous to his departure for Paris, in the garden of the Horticultural Society at Chiswick; and on the 15th of January, at Thornfold Park, near Tunbridge Wells; and on the 30th of January, in the garden of the Royal Observatory at Paris.

An opportunity occurring, three of the needles were sent to England early in April, and, with one sent by Captain Hall from Edinburgh, were vibrated by Captain Chapman, R.A., in the garden of the Horticultural Society, and returned to Paris.

Professor Hansteen's four needles were always kept separate, but those by Mr. Dollond together, and nearly in contact. To try the effect of separation, these were separated from the 14th of March to the 30th of April, and being then again tried in the same place as before, their times of vibration were found unaltered.

The author then states, in the form of an abstract, the results of the several experiments, all the details of which are subjoined in the form of tables. The mean of all gives a ratio of horizontal directive force in Paris greater than in London, in the ratio of 1068 : 1000; and on the supposition that the dip in London is $69^{\circ} 45'$, and in Paris $67^{\circ} 58'$, the ratio of the intensity of directive force on the dipping-needle comes out greater in London than in Paris, by about 15 parts in 1000.

On the Resistance of Fluids to Bodies passing through them. By James Walker, Esq. F.R.S.E. Communicated by Davies Gilbert, Esq. M.P. V.P.R.S. Read May 31, 1827. [*Phil. Trans.* 1828, p. 15.]

The object of this paper is to explain a new mode of measuring the resistance of fluids, which has of late become more than formerly an object of research owing to the introduction of steam navigation.

The resistance of a fluid *per se*, is, theoretically speaking, as the square of the velocity; but, independently of friction and viscosity, this theory is only applicable to the case of a body entirely and deeply immersed. If it float on the surface (as a boat), the elevation of the water in front, and its depression behind, disturbs the exactness of